

and Rouen Railway were made. Generally, the bricks used between Paris and Hardeur are, however, of a red colour, and made of a ferruginous clay. At Hardeur and Havre they are white, the clay being calcareous and impregnated with the marine salts. The mode of burning usually employed is in kilns; but of late, near Rouen, many brickmakers have begun to burn in clamps. Their success hitherto has been very equivocal.

Of late years wooden floors have become general in Paris, but the houses of the poor, and all the offices, passages, and kitchens of the best lodgings, are still paved with tiles; and it may, perhaps, be owing to this custom that Paris is so comparatively free from fires. The tiles are of four sorts for flooring purposes—viz., the large hexagon, of 6½ inches over the angles; the bastard hexagon, of 5½ inches over the angles; and the square tiles, 6½ inches, and 8½th of a side: the thickness varies from 1½ths to 1¼ths. The square tiles are used for the hearths, the hexagonal tiles for flooring. The best are made at Montreuil, but their price is so high that the preference is generally given to the tiles made at Massy, near Palaiseau. Almost all the brickmakers of the neighbourhood of Paris, however, make tiles at the present day, both for flooring and roofing purposes.

Many of the houses of Paris and the neighbourhood are covered with tiles, though the use of this material is rapidly going out of fashion. The best are made at Montreuil, as is the case with flooring tiles. They are of two sizes; for it is to be observed that there is only one shape in general use—the pan tile. *Le grand moule* is about 1 foot long by 9 inches wide and 1 inch thick; the part left uncovered is about 4½ inches. *Le petit moule* is about from 6½ to 7½ wide, by from 10 inches to 11 inches long. The ridge tiles are 1 foot 3 inches long by 1 foot 1 inch development.

A very great number of glazed tiles and common pottery chimneys and stoves are used throughout France. The dearthness of combustibles renders the use of open fire-places too expensive for the lower classes. Iron also is too dear to be employed for grates, stoves, ranges, cheeks, and the thousand uses we make of it in England.*

One of the most ingenious use made of pottery was in the construction of the floors of some houses in a street recently erected in the centre of the grounds of the ancient hotel Rougemont. At the time of the erection of these houses, there was a strike amongst the carpenters. The contractor adopted this manner of executing the floors simultaneously with the walls,—that being the invariable mode of proceeding adopted in Paris. These floors, however, cost more than those executed in the usual manner, and, consequently, have not been imitated. They were executed about 1845.

3rd. *Limes and Cements*.—All calcareous stones, when exposed to a sufficient heat, part with the carbonic acid gas which enters into their combination; but the limes resulting from the calcination assume different appearances, according to the chemical composition of the stones. These appearances are four in number,—at least of those sufficiently frequent in their recurrence to form the basis of a commercial classification. They are:—Firstly, as regards the manner of taking up water, divided into fat or thin limes. The fat limes are those which, in slacking, augment at least one-fourth in volume; the thin limes are those that remain constant in their bulk. Secondly, as regards their setting properties, limes are divided into the hydraulics and the non-hydraulics. The hydraulic limes are invariably thin,—but all thin limes are not hydraulic.

An examination of the elaborate discoveries and researches of the French chemists and

engineers into this still very little cultivated branch of the chemistry of building, would lead us into far too long a discussion at present. Suffice it to say, that the practice of the best architects, and of all the engineers in France, is to use hydraulic lime to the exclusion of others, unless almost insuperable difficulties, owing to their price, occur. In so damp a climate as our own, we should do well to imitate their example; the more especially as we have at hand the means of procuring both natural and artificial hydraulic limes in unlimited quantities.

The fat limes used in Paris are made at Senlis, Melun, Essone, Champigny, Marly, Sevres, &c. The natural hydraulics are made at Senonches, and of late years at Meudon; the artificial hydraulics are made wherever chalk is found, in the proximity of clay, as at Marly, Mantes, and in the neighbourhood of Rouen.

The Lower Seine, from the neighbourhood of Mantes at least, runs through the chalk formation; the country, right and left, is of the same geological character for a great distance. Natural hydraulic limes do not occur until we reach Havre, and all the local consumption is therefore supplied by the factories of artificial hydraulic limes. The most important of these are at Rouen, where they assume very great importance, from the chemical and mechanical skill employed. The materials used are the chalk from the Mount St. Catherine, and the argillaceous deposits of the neighbourhood; the proportions of the different ingredients, and the degree of burning, depending upon the rate of setting required.

At Havre, upon the outcrop of the chalk, or rather at the junction of the chalk and the Wealden formations, a bed of argillaceous limestone is met with, which yields a very superior hydraulic lime. In the valley of Hardeur a large establishment has lately been formed for the making of artificial hydraulics; and all the immense dock or fortification works executed at Havre have been constructed with either one or the other. Cement is only used for pointing, or, on extraordinary occasions, for rendering works exposed to the action of the sea immediately after being finished.

The cements used in Paris are principally made in Burgundy, at Pouilly. They participate of the nature of our Roman cements; but do not acquire so great a degree of hardness. The same objection is to be made to the Vassy cements; and to the artificial cements made at Rouen with chalk and pounded bricks. The French architects and engineers do not advocate the use of cement to the same extent we do in England. Personally, I think they are nearer the truth than we are. It is much to be feared that materials which set so rapidly may decay in the same manner. The processes of nature are slow, at least where great duration is its object; and we are most likely to succeed by following the same course. The competition, moreover, in the supply of cement is so great, that the article, as usually sold, is little better than sand. Even the extreme rapidity of the setting of cement is an objection to its use in many ordinary cases, for it requires so much care in its manipulation as to render it liable to be slighted where the interest, or even the carelessness of the workman, may oppose its receiving proper attention.

Occasionally, in the neighbourhood of the large towns, the houses are entirely built with rubble-stone, or of bricks, and covered with a coat of plaster. Cement is never used for this purpose, nor does there appear to be any necessity for its introduction; the climate of France is sufficiently dry, and the plaster, as usually employed, is sufficiently capable of resisting the atmospheric changes, to render the use of the more expensive material unnecessary. Precautions require, however, to be taken in the application of plaster. The tops of cornices, and all weatherings, require to be covered with zinc; the parts of the houses near the ground must be rendered with a less hygrometric material; but for all other positions plaster succeeds remarkably well. Internally, it is the only material used in any part of France within reasonable distance of water-carriage from the gypsum-quarries. Stuccoes and imitations of marbles are some-

times employed in public buildings, but very rarely in private houses.

4th. *Woods*.—The practice of the French architects in the use of wood differs little from our own. On the sea-board, and in the large commercial towns, Swedish and Baltic fir is principally employed; in the interior oak is cheap enough to insure the preference. The oak used in Paris comes principally from Champagne and Burgundy; lately, however, the Prussian oak has been imported in considerable quantities. For large roofs, Dantzic and other Prussian fir is used; but the architects pay such very low prices that the best woods invariably are sent to England. Indeed, there are few architects who seem to be able to distinguish the Swedish from the Prussian timber, for in all cases I have noticed that for roofing purposes the former is employed where the latter is demanded by the specifications. Indeed, so small is the supply of Baltic timber in France, that in 1848, after the bridges over the Seine had been burnt down by the mobs, it was impossible to find 50,000 cubic feet in all the markets of Dieppe, Fecamp, Havre, Rouen, and Paris.

Norway timber is used largely for purlins, and for partition stuff. The deals and battens imported are of the second and third quality; but as all the better class of joiner's work is executed in wainscot, this becomes of less moment. Some of the French oak is very beautiful, and admirably adapted for joiner's work; but its gradually increasing price, owing to the clearance of the forests, renders necessary the importation of the German, or, as we commonly call it, the Dutch, wainscot. Mahogany is only imported for cabinet-making: its use for joinery, or for ship-building, is almost unknown. Rosewood and ebony are also imported for cabinet-makers. American timber, e.g., pine, spruce, &c., rarely enters France, except for the purpose of making masts and spars of ships; teak is totally unknown, as are the whole tribe of African or Australian woods.

France furnishes very beautiful poplar, ash, and beech timber, which are much used in building. Almost all the slate battening for provincial use is made of poplar; the ash serves for cart-building and carriage-works; the beech is principally employed for piles and gratings, &c., under water. The department of Calvados furnishes some of the finest beech-trees I have ever seen.

In practice the French architects are much behind our own as far as carpentry is concerned. There are, certainly, exceptions. Some of the roofs in Paris are light, elegant, and strong, the thrusts well balanced, the resistances most skilfully calculated; but, as a rule, the scantlings are far too heavy, the framing clumsy, the affectation of mathematical construction too glaring. Little or no precautions are taken to prevent the decay of the timber from the moisture of the walls; the wood itself is often used full of sap, and thoroughly wet—an objection, by the way, which may be made to carpentry in London, for we often see the wood taken from the river, cut up, and placed in buildings long before it can have dried. It is, however, to be observed with reference to the heavy scantlings used by the French architects, that the price of wood-work is about 25 per cent. higher with them than with us. Motives of economy serve as vast incentives to scientific investigations in all countries.

5th. *Metals*.—The metals used in building are iron (cast and wrought), lead, copper, zinc, and some of their compounds.

1 (a). The greater part of the cast-iron used in the valley of the Seine is derived either from the mines upon the Belgian frontier, from the province of Berri, or from England; the importation from our own country being principally for the supply of the markets of Rouen, Havre, and the north-west of France. The wrought-iron comes from Berri and Flanders, and there are some scrap-iron-factories at Paris and Havre.

The great distance the iron has to be transported, and the dearthness of fuel, render its use in the prodigal manner we are accustomed to, quite out of the question. At Paris cast-iron costs about 50 per cent. more than in London; at Havre it costs about 33 per cent. more. Its use is therefore avoided as much as possible, the more especially as wood and stone-

* The clay of Forges de la Seine Inférieure are composed of—

	Forges.	Vanves.
Silica, per cent.	0.050	0.144
Alumina	0.369	0.350
Oxide of iron	trace	0.066
Water	0.118	0.100
Magnesia	—	trace
	1.000	0.990

The clay of Forges is used for pots for glass-making, and similar purposes; that of Vanves for kitchen-tiles.

The bricks used in Paris are either made at Stourbridge, or at Bayange, on the Belgian frontier; some few are made in Burgundy, but they do not resist well.